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Brief report

The fist bump: A more hygienic alternative to the handshake

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Key Words:
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The handshake is a commonplace greeting in many cultures, but it has the potential to transmit infectious organisms directly between individuals. We developed an experimental model to assay transfer of bacteria during greeting exchange, and show that transfer is dramatically reduced when engaging in alternative so-called dap greetings known as the high five and fist bump compared with a traditional handshake. Adoption of the fist bump as a greeting could substantially reduce the transmission of infectious disease between individuals.

Indirect transfer via surfaces such as computer keyboards and door handles is a potential route of transmission for infectious diseases and efforts are made to control such transfer, particularly in hospitals.[1,2] However, direct contact between individuals has the potential for greater efficiency of pathogen transmission, and handshakes are known to transmit bacteria, including potential pathogens.[3,4] Nevertheless, some social/professional contexts place great value in the handshake and its quality.[5-7] Indeed, health professionals have been specifically encouraged to offer handshakes to meet patients' expectations and to develop a rapport with them.[8,9]

Ritualistic touching on meeting is important in diverse cultures across the world and a great variety of such greetings exist, for instance the traditional hongi greeting of the New Zealand Māori involves pressing noses and foreheads together. Although the handshake still dominates in Western culture many popular alternatives known colloquially as dap greetings, such as the high five and the fist bump, are now commonplace, particularly among younger members of society. Even President Barack Obama and the Dalai Lama have tacitly endorsed dap greetings by engaging in public fist bumping.

In our study we sought to determine experimentally if alternative greetings might have different potential for the transmission of microorganisms.

METHODS

An experimental model and assay for bacterial transmission via physical contact was developed using standard microbiologic methods. A greeting donor immersed a sterile-gloved hand into a dense culture (2.4×10^9 CFU/mL) of nonpathogenic *Escherichia coli* and allowed a film of bacteria to dry onto the glove. A greeting was then exchanged with a sterile-gloved recipient. The recipient's glove was immersed in buffer and the number of bacteria washed into the buffer was evaluated (by serial dilution and plating). Greetings were performed according to a balanced crossover study design, with the same participants performing all greetings (donor hand span, 21.4 cm and recipient hand span, 20.6 cm) in a random order, with 5-fold replication. To determine the relative area of contact in each greeting, the donor's glove was sprayed copiously in acrylic paint. After greeting, the area of paint transferred onto the recipient's glove was measured.

RESULTS

Nearly twice as many bacteria were transferred during a handshake (mean 1.24×10^8 CFU) compared with a high five, whereas the fist bump consistently gave the lowest transmission (Fig 1A). The area of contact made during a greeting was found to correlate with the relative transfer of bacteria (Fig 1A and 1B), with the largest contact area obtained from the handshake (mean 157.4 cm^2).

The relationship between bacterial transfer and contact area is consistently positive although not linear, with disproportionately high transmission of bacteria through a handshake (Fig 1B). Because handshakes typically last longer than fist bumps or high fives, bacterial transfer was measured again with each greeting prolonged for 3 seconds (the duration of the model handshake we employed). Transfer of bacteria did not increase significantly for the prolonged high five (Student t test $P > .5$); however, transfer via fist bump was significantly increased by prolonging for 3 seconds

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Conflicts of interest: None to report.

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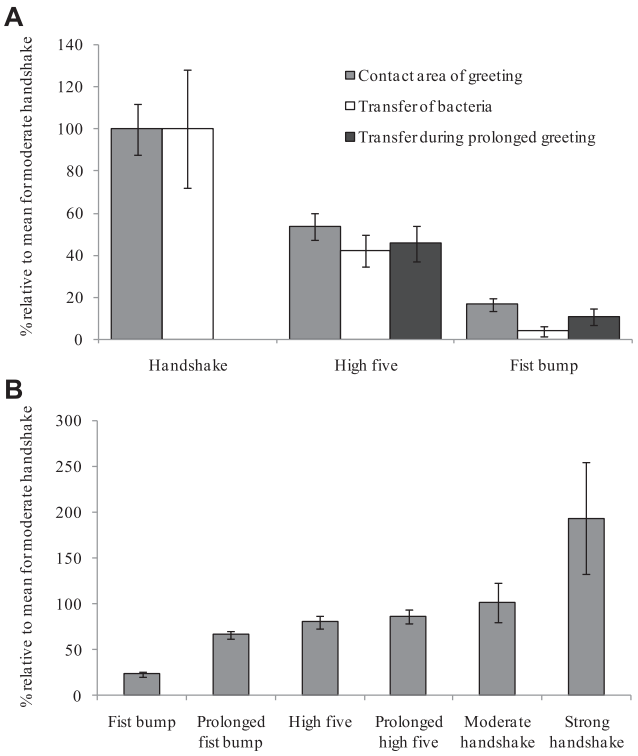

Fig 1. Transfer of bacteria in 3 greetings. (A) Area of contact (pale grey), transfer of bacteria during natural greetings (white), and prolonged greetings (dark grey) are all expressed as a percentage of values obtained for the handshake. (B) Transfer per area of contact in the 3 greetings (prolonged and natural duration), and for strong and moderate-strength handshakes (as a percentage relative to the moderate-strength handshake). Error bars denote ± 1 standard deviation (n = 5 in all cases).

($P < .05$). We also assessed if the grip exerted during a handshake affected bacterial transfer by applying differing amounts of gripping pressure. Moderate and strong grips were measured using a Takei TKK5401 dynamometer (Takei Scientific Instruments Co Ltd, Tokyo, Japan), giving mean ± standard deviation readings of 49 ± 4 kg and 25 ±1 kg, respectively. Strong grips resulted in significantly greater transfer of bacteria per area of contact than moderate-strength handshakes (Fig 1B) ($P < .01$).

DISCUSSION

This experimental model provides evidence that dap greetings result in reduced transmission of bacteria between participants compared with a handshake. The high transmission level observed for handshakes does not appear to be purely a function of its large contact area, but also depends on duration and strength. Transmission is greater with increased duration and grip, which presumably increases the intimacy of association between hands.

Using a laboratory model meant that we were able to eliminate all variables except those deliberately assessed during the experiment: the type of greeting, greeting longevity, and the force of greeting contact. Outside the laboratory, many other variables will presumably also affect transmission. For instance, the 3 greetings tested involve contact between different parts of the hand, and it is probable that in everyday life different parts of a hand would have differing amounts of bacterial fauna, which would also depend on the participants' hygiene habits, occupation, and location.

Although we investigated the transfer of a nonpathogenic bacterium, similar results would be expected for other pathogenic microorganisms (including viruses such as influenza), some of which are very costly in both human and economic terms. In the United States alone, community-acquired pneumonia causes > 60,000 deaths annually, with an estimated annual economic cost of > $17 billion.[10] It is unlikely that a no-contact greeting could supplant the handshake; however, for the sake of improving public health we encourage further adoption of the fist bump as a simple, free, and more hygienic alternative to the handshake.

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